

System Engineering Status
GLAST PSR
02 July 2003

J.Leibee

RFA Status

- **Total RFAs (Spacecraft PDR/LAT CDR/MPDR) Status**
 - 108 Total, 0 Closed
 - Status Tracking Matrix to be developed
- **SC PDR & SC FSW PDR**
 - All RFAs assigned with due dates
 - 43 Total, 0 Closed, 10 Responses to GPO Expected this week
 - FSW: 14 Total, 0 Closed, 1 Response to GPO Expected this week
- **LAT CDR**
 - All RFAs assigned to SLAC personnel
 - 37 Total
- **MPDR**
 - RFAs assigned
 - 14 Total, 0 Closed

GLAST Project CCR Status

- **One CCB held in June**
 - 11 CCRs Brought to the Board
 - 7 Approved, 3 Deferred to Incorporate Comments, 1 Withdrawn
- Next CCB scheduled for July 1
 - 13 CCRs to be dispositioned, including 2 from last CCB
- **15 additional CCRs in the system for review**
- **Continuous Risk Management Plan and SEMP in process of being updated**
 - Expect to board at next CCB on 10 July

Requirements Status

- **Total Number of TBXs in Project Documents - 5**
 - MSS: 2, SPS: 2, LAT-SC IRD: 1, GBM-SC IRD: 0
 - 1 TBR each in MSS and SPS that will remain (SC Outages)
 - 3.1.4.2.2.1 Spacecraft Outages: The total time spent in outages that prevent acquisition of science data, i.e., those that result in safe mode, shall not exceed 1 % (TBR) of the operational life of the mission.
 - SPS3.1.6 Availability: The total time spent in spacecraft outages that prevent acquisition of science data, i.e., those that result in safe mode, shall not exceed 1 % (TBR) of the operational life of the mission.
 - CCR to be written to remove TBD in Ground System section of MSS
 - CCR reviewed yesterday to remove TBR in MSS
 - TBR in LAT IRD for 75 W Solar Array backload to be negotiated (both sides meet rqmt, LAT would like relief to provide additional margin)
- **Total Number of TBXs in ICDs - 51**
 - LAT-SC ICD: 20, GBM-SC ICD: 31
 - Generating a closure plan and date for each of these

Mass Budget

	mass (kg)			
	Allocation	Estimate	Margin	%
• Dry SC	1169	880	289	33
• SC including propellant	1530	1240	290	23
• LAT	3000	2680	320	12
• GBM	<u>97</u>	<u>84</u>	<u>13</u>	<u>15</u>
• Observatory mass	4627	4004	623	16

- 10 kg decrease in spacecraft estimate
- Delta II Heavy throw weight to 575 km with cg at 1.37 m = 4627 kg

Power Budget

Orbit Average Power (Watts)

	Allocation	Estimate	Margin	%
Spacecraft	985	801	184	23
LAT	650	573	77	13
GBM	<u>65</u>	<u>55</u>	<u>10</u>	<u>18</u>
Observatory total	1700	1429	271	19

- 10 Watt decrease in estimated spacecraft power consumption

Study Status

#	Study	Status	Closure Plan
1	TDRSS SSA Return 1,2,4,8 kbps Capability	CCR drafted by GPO/Spectrum to state that positive margin for 1,2,4 kbps is a requirement; not for 8 kbps which will be verified via ground testing	CCR submitted - 7/2
2	Observatory Switch and Repoint Capability (10 switches / 5 repoints per orbit)	GPO preparing separate requirements for command buffer sizing and slew capability; Number of slews per orbit limited by RW thermal performance; Spectrum to perform thermal analysis, slew definitions and provide adjustable slew parameters (rate, acceleration) for on-orbit ops	Spectrum to complete slew definitions and thermal analysis - 7/14 Review with SWG - 7/21 Submit CCR - 7/28
3	Observatory Slew Performance	CCR drafted by GPO/Spectrum to revise requirement to account for slew performance under 3 RW control; Slew requirement of 75 deg in 10 min met 100% of time under 4 RW control, 79% under 3 RW control	Draft CCR - 7/1 Review with SWG - 7/21 Submit CCR - 7/28
4	Reed-Solomon Encoding on TDRSS Link	Draft CCR wording circulating within project systems engineering office. Spectrum has reviewed and has small impact – will provide impact once the CCR verbiage is finalized by GPO.	Finalize verbiage of CCR – 7/2 Enter CCR in system – 7/3 Approve CCR – next CCB. (asap – out of board potentially)
5	51 kbps HK Telemetry Rate	Rationale for 51 vs. 32 kbps HK telemetry presented at monthly 6/26 by SAI. Tailored and reviewed by GPO on 6/30. Tuning for presentation to GPO/PM planned for this week.	Presentation of approach and plan to GPO to be scheduled - 7/8.
6	7 sec Latency	Clarification and understanding of the latency allocations within the system between GPO and Spectrum. Spectrum to provide current allocation breakdown.	No timetable

Ku-band Study Summary

- **Primary Features**
 - 75 Mbps return link rate for SSR downlink (65 mbps science/10 mbps housekeeping)
 - Real-time housekeeping data
 - Non-deployable gimbaled antenna
 - Approximately 2-seven minute contacts per orbit due to geometric constraints
 - 2-four and one-half minute contacts per day to downlink SSR data
- **Most significant design changes**
 - New High Speed Down Link (HSDL) Board to Interface to X-band and Ku-band Transmitter
 - Modify Baseline UDL Board to :
 - Provide LVDS Interface on SSR HK Playback
- **Most significant impacts/issues**
 - Schedule: 5 months to spacecraft I&T (C&DH redesign); 20 additional days for observatory I&T (mitigation possible for both)
 - Ops: Limited visibility results in impacts on scheduling TDRSS; autonomous repointing/TOO could result in missed contacts
 - Impact of possible stuck antenna (plume impingement/thermal)
- **Forward Plan**
 - Develop mitigation plans (e.g. reducing downlink rate to 40 Mbps simplifies C&DH design)
 - Complete thermal analysis and develop NTE price

Observatory STOP Analysis Plans

•Cycle 1: (6/16 – 7/30) Start with PDR models

- ✓ 6/13/03 Spectrum Special Study Task 5 turn on
- ✓ 6/20/03 Lou identify thermal load cases and get them reviewed by Jeff Wang and his branch
 - LAT requested TIM next week to resolve any issues
- 7/30/03 Spectrum complete reduced set of analysis
 - Gradient cases (x, y, z, and specific cases of interest)
 - Greatest value of this cycle
 - Independent of thermal model
 - Can compare these results with SLAC/Lockheed's current gradient estimates
 - 4 thermal load cases
- 1 Mechanical and 2 Thermal model TIMs at SLAC during Cycles 1 and 2

•Cycle 2: (8/1 – 9/30) Use updated CDR LAT model

- Spectrum Special Study Task 5
- X 6/27/03 SLAC deliver updated FEM and thermal model to GSFC
- 7/30/03 GSFC deliver LAT FEM and thermal model to Spectrum
- 9/30/03 Spectrum complete reduced set of analysis (same as Cycle 1)

•Cycle 3: Use final CDR LAT model

- 9/1/03 (TBR) SLAC deliver post-CDR FEM and thermal model to GSFC
- 10/1/03 (TBR) GSFC deliver FEM and thermal model to Spectrum
- 1/10/04 Spectrum complete full set of analysis (same as Cycles 1 & 2, plus transient cases)

•Cycle 4: Use T/V correlated LAT model and TBD SC model

- (need to optimize phasing in terms of SC optical bench testing, SC CDR design completion, SC bus testing etc.)

•Cycle 5: Use T/V correlated observatory model

ORSAT Analysis Result Summary To Date

Items of Interest			JSC:Oct'01 ^{(1), (2)} 75% mass modeled		GSFC: Apr'03 86% mass modeled		JSC: June'03 ⁽⁴⁾		
Item	Material	#	DCA (m²)	KE (J)	DCA (m²)	KE (J)	DCA (m²)	KE (J)	
Spacecraft	Int. Elec. Module (IEM)	Aluminum	2		0.9	>> 15			
	Pwr Dist. Unit (PDU)	Aluminum	1		1.0	>> 15			
	Propellant Tank	Ti Alloy	1		2.3	4950.0			
	ACD – Top Shield ⁽³⁾	Nextel	Variable	4.8	Low	5.74 (1)	2.2		
	ACD – Side Shield ⁽³⁾	Nextel	Variable	Not used	Low	3.80 (1)	1.3		
LAT	Tracker Tray Closeout	Carbon-Carbon	1216	547.2	Low	595.8	5.7	595.8	< 15
	Tracker Thin Foil	Tungsten	3072	1348.6	Low	1443.8	0.4	1443.8	< 15
	Tracker Thick Foil	Tungsten	1024	449.5	Low	450.6	12.88	450.6	24.1
	Lat Grid	Aluminum	1	0.0	High	3.1	58,700		
	Total DCA (No KE Threshold)			2350		2502.8			
	Total DCA (with 15J KE Threshold)			NA		7.3			
Notes: (1)Spacecraft not included in original study, (2) report indicated only that KE for certain components was very small (3) ACD shield modeled as single piece of area equal to top layer in Oct 01, modeled as top layer and 4 side layers in Apr '03 and June '03' (4) June '03 ORSAT 5.8 includes lower drag for sub-sonic speeds which has impact on KE computation as seen in thick tracker foil •JSC runs will be final determination: full 100% observatory model provided on 7/1 •Final results expected week of July 14th									

Upcoming Events

- **Regularly scheduled meetings-System Engineering Staff (every Monday); ISET (every Tuesday); Subsystem Status (every Wednesday)**
- **STOP Analysis Telecon-bi-weekly (minimum)**
- **Risk Management Practices-03 July**
- **CCB-10 July**
- **Integrated Modeling Seminar-15 July**
- **GSFC Encryption Policy Formulation-TBD**
- **GBM DPU CDR-05/06 August**